Solid Earth Discuss., 7, C1339–C1341, 2015
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Solid Earth Discussions
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Interactive comment on "Brittle grain size reduction of feldspar, phase mixing and strain localization in granitoids at mid-crustal conditions (Pernambuco shear zone, NE Brazil)" *by* G. Viegas et al.

Anonymous Referee #1

Received and published: 12 November 2015

This is a referee comment on the paper entitled "Brittle grain size reduction of feldspar, phase mixing and strain localization in granitoids at mid-crustal conditions (Pernambuco shear zone, NE Brazil)" by G. Viegas et al.

General comments This paper described microstructural characteristics of a shear zone (Pernambuco shear zone, NE Brazil) in granitoids, formed under relatively dry mid-crustal conditions (∼500–550 °C, 500 MPa). The authors concluded that brittle grain size reduction of feldspars resulted in the formation of ultrafine-grained polyphase feldspathic bands and triggered a switch from fracturing to grain-size sensitive creep;

strain rate in the feldspar-rich aggregate deforming by diffusion creep was one order of magnitude faster than in monophase quartz ribbons deforming by dislocation creep. The descriptions of microstructures and textures of feldspars and quartz presented in this paper are robust, and discussion and conclusions are reliable and interesting. This paper contributes to understand deformation process/mechanism of the middle crust and strength evolution of the lithosphere. The authors described that there is no hydration reactions of feldspar, suggesting dry condition during deformation. On the other hand, based on the observations such as (1) growth of new feldspar grains within intracrystalline fractures; (2) crystallographic preferred orientation (CPO) of plagioclase; (3) curved/undulose boundaries of K-feldspar grains; (4) precipitation of quartz in cavities; and (5) the pitted grain boundaries of feldspars, the authors argued a fluid phase was present on grain boundaries during deformation. This inference is reasonable, but I do not understand the authors have considered how much fluid content was present in the system; fluids were not sufficient to hydrate feldspars, but facilitated element diffusion along grain boundaries? I would like you to discuss the amount of H2O and diffusivity of elements during deformation.

Specific comments (1) P2963, L5–8: I do not see any preferential distribution of plagioclase in the inner parts of the bands and K-feldspar in the periphery of the bands in these figures.

(2) P2963, L19–23: I do not identify which grain is quartz, and then cannot justify the microstructural characteristics. Please identify quartz grains in these figures.

(3) P2964, L15–17: The data set of plagioclase chemistry is small, and more data are needed.

(4) P2970, L4–17: The authors described the fine-grained feldspars filling the intracrystalline fractures are as "new grains" They are grains with overgrown new rims around old cores, and then they are not "new grains"!

(5) P2971, L5–7: This interpretation is reasonable, but suppression of the secondary

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phases on the grain growth of quartz must be considered to evaluate the grain size of quartz.

(6) P2972, L14–24: The authors argued that the microstructures (i.e., curved/undulose boundaries of K-feldspar grains, precipitation of quartz in cavities, and the pitted grain boundaries of feldspars) are indicative of a presence of fluid on grain boundaries during deformation. This inference is reasonable, but I do not understand the authors have considered how much fluid content was in the system; fluids were not sufficient to hydrate feldspars, but facilitated element diffusion along grain boundaries? I would like you to discuss the amount of H2O and diffusivity of elements during deformation.

(7) P2974, L7–10: Please specify the values of parameters used to evaluate the relationship between differential stress and temperature. I would like to know whether they used the flow law for dry plagioclase aggregate or wet aggregate.

Technical corrections (1) P2969, L11: Alb91 should be Ab91.

(2) Figure 6: Please denote quartz grains in these BSE images.

(3) Figure 11: The misorientation profiles along A–A' and B–B' are for lines A–A' and B–B' in Figure 10, respectively? If so, please describe that in the captions of Figures 10 and 11. Furthermore, what is color code in Figure 10 for? If it represents misorientation of plagioclase (left) and K-feldspar (right), reference point should be indicated in each figure. What is arrow at color bar?

Interactive comment on Solid Earth Discuss., 7, 2953, 2015.